

CLAIMS:

1. A sensor device comprising:
an optical storage medium; and
a sensor film comprising a polymer support in combination with an analyte-specific reagent applied to at least a portion of the optical storage medium.
2. The sensor device of claim 1 wherein the optical storage medium is selected from the group consisting of CDs, CD-Rs, CD-RWs, DVDs, DVD-Rs, DVD-RWs, DVD-5s, DVD-9s, DVD-10s, DVD-18s, magneto-optical discs, and Blu-ray discs.
3. The sensor device of claim 1 wherein the polymer support is a gas-permeable polymer.
4. The sensor device of claim 1 wherein the polymer support is selected from the group consisting of poly(anilines), poly(thiophenes), poly(pyrroles), poly(acetylenes), poly(alkenes), poly(dienes), poly(acrylics), poly(methacrylics), poly(vinyl ethers), poly(vinyl thioethers), poly(vinyl alcohols), poly(vinyl ketones), poly(vinyl halides), poly(vinyl nitriles), poly(vinyl esters), poly(styrenes), poly(arylenes), poly(oxides), poly(carbonates), poly(esters), poly(anhydrides), poly(urethanes), poly(sulfonates), poly(siloxanes), poly(sulfides), poly(thioesters), poly(sulfones), poly(sulfonamides), poly(amides), poly(ureas), poly(phosphazenes), poly(silanes), poly(silazanes), poly(benzoxazoles), poly(oxadiazoles), poly(benzothiazinophenothiazines), poly(benzothiazoles), poly(pyrazinoquinoxalines), poly(pyromellitimides), poly(quinoxalines), poly(benzimidazoles), poly(oxindoles), poly(oxoisoindolines), poly(dioxoisoindolines), poly(triazines), poly(pyridazines), poly(piperazines), poly(pyridines), poly(piperidines), poly(triazoles), poly(pyrazoles), poly(pyrrolidines), poly(carboranes), poly(oxabicyclononanes), poly(dibenzofurans), poly(phthalides), poly(acetals), poly(anhydrides), carbohydrates, and copolymers of monomeric constituents of the above.

5. The sensor device of claim 1 wherein the polymer support comprises a hydrogel.

6. The sensor device of claim 5 wherein the hydrogel is tied via radical cross-linking of hydrophilic polymers selected from the group consisting of poly(acrylic acids), poly(methacrylic acids), poly(hydroxyethylmethacrylates), poly(glyceryl methacrylates), poly(vinyl alcohols), poly(ethylene oxides), poly(acrylamides), poly(N-acrylamides), poly(N,N-dimethylaminopropyl-N'-acrylamides), poly(ethylene imines), sodium poly(acrylates), potassium poly(acrylates) polysaccharides, poly(vinyl pyrrolidones), cellulose derivatives, and copolymers of monomeric constituents of the above.

7. The sensor device of claim 5 wherein the hydrogel is a poly(hydroxyethylmethacrylate) hydrogel tied via chemical cross-linking with an agent selected from the group consisting of N,N'-methylenebisacrylamide, polyethylene glycol diacrylate, triethylene glycol diacrylate, tetraethylene glycol dimethacrylate, tripropylene glycol diacrylate, pentaerythritol tetraacrylate, di-trimethylolpropane tetraacrylate, dipentaerythritol pentaacrylate, trimethylolpropane triacrylate, pentaerythritol triacrylate, propoxylated glycetyl triacrylate, ethoxylated pentaerythritol tetraacrylate, ethoxylated trimethylolpropane triacrylate, hexanediol diacrylate, and hexanediol dimethacrylate.

8. The sensor device of claim 5 wherein the hydrogel is a cellulose derivative tied via chemical cross-linking with an agent selected from the group consisting of dialdehydes, diepoxides, and polybasic acids.

9. The sensor device of claim 5 wherein the hydrogel is a graft copolymer of poly(ethylene oxide) with polymers selected from the group consisting of poly(ethyleneglycol), poly(acrylic acid), poly(vinyl pyrrolidone), poly(vinyl acetate), poly(vinyl alcohol), N,N-dimethylaminoethyl methacrylate, poly(acrylamide-co-methyl methacrylate), poly(N-isopropylacrylamide), and poly(hydroxypropyl methacrylate-co-N,N-dimethylaminoethyl methacrylate).

10. The sensor device of claim 5 wherein the hydrogel is a graft copolymer selected from the group consisting of poly(vinyl pyrrolidone)-co-polystyrene copolymers, polyurethanes, polyurethaneureas in combination with poly(ethylene oxide), polyurethaneureas in combination with poly(acrylonitrile)-co-poly(acrylic acid), poly(acrylonitrile) derivatives, poly(vinyl alcohol) derivatives, and poly(acrylic acid) derivatives.

11. The sensor device of claim 1 wherein the polymer support comprises a polymer blend.

12. The sensor device of claim 1 wherein the sensor film is selectively permeable to an analyte on the basis of size of the analyte.

13. The sensor device of claim 1 wherein the sensor film is selectively permeable to an analyte on the basis of phase of the analyte.

14. The sensor device of claim 1 wherein the sensor film is selectively permeable to an analyte on the basis of solubility of the analyte.

15. The sensor device of claim 1 wherein the sensor film is selectively permeable to an analyte on the basis of ion charge of the analyte.

16. The sensor device of claim 1 wherein the analyte-specific reagent is selected from the group consisting of organic dyes, inorganic dyes, nanocrystals, nanoparticles, quantum dots, organic fluorophores, inorganic fluorophores, IR absorbing dyes, near infrared absorbing materials, UV absorbing dyes, photochromic dyes, and thermochromic dyes.

17. The sensor device of claim 1 wherein the analyte-specific reagent is selected from the group consisting of xanthene dyes, acridine dyes, azo dyes, porphyrin dyes, phthalocyanine dyes, cyanine dyes, merocyanine dyes, styryl dyes, oxonol dyes, triaryl methane dyes, methylene blue, phenol blue, bromothymol blue and bromocresol green.

18. The sensor device of claim 1 wherein the analyte-specific reagent is a light absorbing reagent selected from the group consisting of carbon black, photochromic quinones, photochromic viologens, spirooxazines, and spiropyrans.

19. The sensor device of claim 1 wherein the analyte-specific reagent is responsive to light at about 200 nm to about 1100 nm.

20. The sensor device of claim 1 wherein the analyte-specific reagent is responsive to light at about 300 nm to about 1000 nm.

21. The sensor device of claim 1 wherein the analyte-specific reagent is responsive to light at about 350 nm to about 950 nm.

22. The sensor device of claim 1 further comprising an adhesive to adhere the sensor film to the optical storage medium.

23. The sensor device of claim 22 wherein the adhesive comprises a pressure sensitive adhesive.

24. The sensor device of claim 1 further comprising a solvent-resistant overlayer over the sensor film.

25. The sensor device of claim 24 wherein the solvent-resistant overlayer is selected from the group consisting of random copolymers of tetrafluoroethylene and perfluoro-2,2-dimethyl-1,3-dioxole, perfluorosulfonate ionomers, and hydrogels.

26. A method for producing a sensor device comprising:
selecting an optical storage medium for use as a substrate;
selecting a polymer support;
adding an analyte-specific reagent to the polymer support to form a sensor film; and
applying the sensor film to the optical storage medium.

27. The method of claim 26 wherein the step of selecting an optical storage medium for use as a substrate utilizes an optical storage medium selected from the

group consisting of CDs, CD-Rs, CD-RWs, DVDs, DVD-Rs, DVD-RWs, DVD-5s, DVD-9s, DVD-10s DVD-18s, magneto-optical discs, and Blu-ray discs.

28. The method of claim 26 wherein the step of selecting a polymer support comprises selecting a chemically-selective polymer as the polymer support.

29. The method of claim 26 wherein the step of selecting a polymer support comprises selecting a size-selective polymer as the polymer support.

30. The method of claim 26 wherein the step of selecting a polymer support utilizes a polymer selected from the group consisting of poly(anilines), poly(thiophenes), poly(pyrroles), poly(acetylenes), poly(alkenes), poly(dienes), poly(acrylics), poly(methacrylics), poly(vinyl ethers), poly(vinyl thioethers), poly(vinyl alcohols), poly(vinyl ketones), poly(vinyl halides), poly(vinyl nitriles), poly(vinyl esters), poly(styrenes), poly(arylenes), poly(oxides), poly(carbonates), poly(esters), poly(anhydrides), poly(urethanes), poly(sulfonates), poly(siloxanes), poly(sulfides), poly(thioesters), poly(sulfones), poly(sulfonamides), poly(amides), poly(ureas), poly(phosphazenes), poly(silanes), poly(silazanes), poly(benzoxazoles), poly(oxadiazoles), poly(benzothiazinophenothiazines), poly(benzothiazoles), poly(pyrazinoquinoxalines), poly(pyromellitimides), poly(quinoxalines), poly(benzimidazoles), poly(oxindoles), poly(oxoisoindolines), poly(dioxoisoindolines), poly(triazines), poly(pyridazines), poly(piperazines), poly(pyridines), poly(piperidines), poly(triazoles), poly(pyrazoles), poly(pyrrolidines), poly(carboranes), poly(oxabicyclononanes), poly(dibenzofurans), poly(phthalides), poly(acetals), poly(anhydrides), carbohydrates, and copolymers of monomeric constituents of the above.

31. The method of claim 26 wherein the step of selecting a polymer support comprises selecting a polymer blend as the polymer support.

32. The method of claim 26 wherein the step of adding the analyte-specific reagent to the polymer support comprises depositing the analyte-specific reagent onto a pre-formed polymeric support.

33. The method of claim 32 wherein the step of depositing the analyte-specific reagent onto the pre-formed polymeric support occurs by a method selected from the group consisting of ink-jet printing, microarraying, robotic spotting, and screen printing.

34. The method of claim 26 further comprising placing the polymer support in a solvent and then adding the analyte-specific reagent to form the sensor film.

35. The method of claim 34 wherein the step of placing the polymer support in a solvent comprises placing an amorphous fluoropolymer in perfluoro(2-butyl tetrahydrofuran).

36. The method of claim 26 wherein the step of adding an analyte-specific reagent to the polymer support to form a sensor film utilizes an analyte-specific reagent selected from the group consisting of organic dyes, inorganic dyes, nanocrystals, nanoparticles, quantum dots, organic fluorophores, inorganic fluorophores, IR absorbing dyes, UV absorbing dyes, photochromic dyes, and thermochromic dyes.

37. The method of claim 26 wherein the step of adding an analyte-specific reagent to the polymer support to form a sensor film utilizes an analyte-specific reagent selected from the group consisting of xanthene dyes, acridine dyes, azo dyes, porphyrin dyes, phthalocyanine dyes, cyanine dyes, merocyanine dyes, styryl dyes, oxonol dyes, triarylmethane dyes, methylene blue, phenol blue, bromothymol blue and bromocresol green.

38. The method of claim 26 wherein the step of adding an analyte-specific reagent to the polymer support to form a sensor film utilizes a light absorbing analyte-specific reagent selected from the group consisting of carbon black, photochromic quinones, photochromic viologens, spirooxazines, and spiropyrans.

39. The method of claim 26 wherein the step of applying the sensor film to the optical storage medium comprises using an adhesive to adhere the sensor film to the optical storage medium.

40. The method of claim 39 wherein the step of applying the sensor film to the optical storage medium comprises using a pressure-sensitive adhesive to adhere the sensor film to the optical storage medium.

41. The method of claim 39 wherein the step of applying the sensor film to the optical storage medium with an adhesive further comprises using a light source to cure the adhesive.

42. The method of claim 26 wherein the step of applying the sensor film to the optical storage medium further comprises wetting a surface of the optical storage medium with a solvent prior to applying the sensor film.

43. The method of claim 42 wherein the wetting of a surface of the optical storage medium with a solvent utilizes a solvent selected from the group consisting of 1-methoxy-2-propanol, isopropyl alcohol, ethyl alcohol, ethanol, and 2-propanol.

44. The method of claim 26 further comprising applying a solvent-resistant overlayer to the sensor film.

45. The method of claim 44 wherein the step of applying the solvent-resistant overlayer to the sensor film utilizes a solvent-resistant overlayer selected from the group consisting of random copolymers of tetrafluoroethylene and perfluoro-2,2-dimethyl-1,3-dioxole, perfluorosulfonate ionomers, and hydrogels.

46. A method for producing a sensor device comprising:
selecting a substrate;
selecting a polymer support;
selecting an optical storage medium for use as a substrate;
adding an analyte-specific reagent to the polymer support to form a sensor film;
exposing the sensor film to an analyte; and

applying the sensor film to the optical storage medium after exposure of the sensor film to the analyte to produce a sensor device.

47. The method of claim 46 wherein the step of applying the sensor film to the optical storage medium after exposure of the sensor film to the analyte comprises applying the sensor film to the optical storage medium so that the analyte-specific reagent is positioned between the optical disc and the polymer support.

48. The method of claim 46 wherein the step of applying the sensor film to the optical storage medium after exposure of the sensor film to the analyte comprises applying the sensor film to the optical storage medium so that the polymer support is positioned between the analyte-specific reagent and the optical disc.

49. The method of claim 46 wherein the step of selecting a polymer support utilizes a polymer selected from the group consisting of poly(anilines), poly(thiophenes), poly(pyrroles), poly(acetylenes), poly(alkenes), poly(dienes), poly(acrylics), poly(methacrylics), poly(vinyl ethers), poly(vinyl thioethers), poly(vinyl alcohols), poly(vinyl ketones), poly(vinyl halides), poly(vinyl nitriles), poly(vinyl esters), poly(styrenes), poly(arylenes), poly(oxides), poly(carbonates), poly(esters), poly(anhydrides), poly(urethanes), poly(sulfonates), poly(siloxanes), poly(sulfides), poly(thioesters), poly(sulfones), poly(sulfonamides), poly(amides), poly(ureas), poly(phosphazenes), poly(silanes), poly(silazanes), poly(benzoxazoles), poly(oxadiazoles), poly(benzothiazinophenothiazines), poly(benzothiazoles), poly(pyrazinoquinoxalines), poly(pyromellitimides), poly(quinoxalines), poly(benzimidazoles), poly(oxindoles), poly(oxoisoindolines), poly(dioxoisoindolines), poly(triazines), poly(pyridazines), poly(piperazines), poly(pyridines), poly(piperidines), poly(triazoles), poly(pyrazoles), poly(pyrrolidines), poly(carboranes), poly(oxabicyclononanes), poly(dibenzofurans), poly(phthalides), poly(acetals), poly(anhydrides), carbohydrates, and copolymers of monomeric constituents of the above.

50. The method of claim 46 wherein the step of selecting a polymer support comprises selecting a polymer blend as the polymer support.

51. The method of claim 46 wherein the step of adding the analyte-specific reagent to the polymer support comprises depositing the analyte-specific reagent onto a pre-formed polymeric support.

52. The method of claim 51 wherein the step of depositing the analyte-specific reagent onto a pre-formed polymeric support utilizes a method selected from the group consisting of ink-jet printing, microarraying, robotic spotting, and screen printing.

53. The method of claim 46 wherein the step of selecting a polymer support comprises selecting an amorphous fluoropolymer dissolved in perfluoro(2-butyl tetrahydrofuran).

54. The method of claim 46 wherein the step of adding an analyte-specific reagent to the polymer support to form a sensor film utilizes an analyte-specific reagent selected from the group consisting of organic dyes, inorganic dyes, nanocrystals, nanoparticles, quantum dots, organic fluorophores, inorganic fluorophores, IR absorbing dyes, UV absorbing dyes, photochromic dyes, and thermochromic dyes.

55. The method of claim 46 wherein the step of applying the sensor film to the optical storage medium comprises using an adhesive to adhere the sensor film to the optical storage medium.

56. The method of claim 55 wherein the step of applying the sensor film to the optical storage medium comprises using a pressure-sensitive adhesive to adhere the sensor film to the optical storage medium.

57. The method of claim 46 wherein the step of applying the sensor film to the optical storage medium further comprises wetting a surface of the optical storage medium with a solvent.

58. The method of claim 57 wherein the step of wetting a surface of the optical storage medium with a solvent utilizes a solvent selected from the group

consisting of 1-methoxy-2-propanol, isopropyl alcohol, ethyl alcohol, ethanol, and 2-propanol.

59. The method of claim 46 further comprising applying a solvent-resistant overlayer to the sensor film.

60. The method of claim 46 wherein the step of applying a solvent-resistant overlayer to the sensor film utilizes a solvent-resistant overlayer selected from the group consisting of random copolymers of tetrafluoroethylene and perfluoro-2,2-dimethyl-1,3-dioxole, perfluorosulfonate ionomers, and hydrogels.

61. A method for producing a sensor device comprising:
selecting a substrate;
selecting a polymer support;
adding an analyte-specific reagent to the polymer support to form a sensor film; and
applying the sensor film to the substrate after exposure of the sensor film to the analyte.

62. The method of claim 61 wherein the step of applying the sensor film to the substrate after exposure of the sensor film to the analyte comprises applying the sensor film to the substrate so that the analyte-specific reagent is positioned between the substrate and the polymer support.

63. The method of claim 61 wherein the step of applying the sensor film to the substrate after exposure of the sensor film to the analyte comprises applying the sensor film to the substrate so that the reagent polymer support is positioned between the analyte-specific reagent and the substrate.